INDUSTRIAL TRAINING PROGRAMS FOR SKILLED WORKMEN

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General Hershey would like to have industry train a person so that he could replace another individual if a job were vacant due to the need of the Army for a man. Industry has been working on this problem for a long time. Their long range attempt to circumvent this lack of trained manpower has resulted in an educational program that is their apprentice system.

Many means have been used to date to produce a trained worker. They range from "90-day wonder" courses to four-year apprenticeships. Most of the "90-day wonders" are taught to do a specific operation on a specific machine and must be retrained for other work in a shop. They are not told the reason for doing certain operations and have little or no conception of the function of the piece they are manufacturing in the completed job. Other persons may be trained to operate a machine for many varied types of jobs, but here again they are at a loss when placed in front of a different type of machine. The widest used type of training is probably apprenticeship.

Apprenticeship is usually considered as a thorough mastery of a portion or all of a specific trade. Modern apprentices differ considerably from their union and guild predecessors. Many types of apprentice programs have been developed. They range from testing courses for engineering graduates to bricklaying apprenticeships. Until a few years ago, one large manufacturing concern had a six-year course for bricklayers. These courses include apprentice training courses to fit graduates for positions as machinists, toolmakers, diemakers, molders, pattern maker, mechanics, draftsmen, tool designers, foremen, and instructors; student engineering courses to train engineers for positions in design, executive and commercial departments; factory training courses for persons interested in executive work in manufacturing; and general business courses.

A program which might be chosen as typical of the apprenticeships would be a machinist apprentice training course. Selection of candidates for such a program begins with an examination in mathematics. Starting with a typical group of 600 applicants, the mathematics test thins the group to about 60. High school records, recommendations, intelligence examinations, and mechanical aptitude tests reduce this number to about 50. Interviews reduce the group to about 24 and a physical examination may reject some more individuals.

Of this group of 24 about 16 graduate from the apprentice course and of this 16 about 5 graduate from both the apprentice course and a technical night school course. Thus 2.67 per cent of the applicants graduate from the apprentice course and 0.83 per cent graduate from both courses.

A four-year machinist apprentice spends about 7200 hours actually working on his machine and about 1100 hours in class in his last two years. Seventy-two per cent of industries with apprenticeships devote four years to the training of the neophyte.

In shop class, the apprentice is shown the conventional procedure for machining a given part on, say, a lathe. In his classes after working hours he is shown movies on the production of various materials, makes drawings, and learns to read blueprints. Also his math class works directly on shop problems.

One apprentice's four years of being introduced to the trade of tool and die making may be looked at as typical of many cases in industry. After being accepted as an apprentice and passing his

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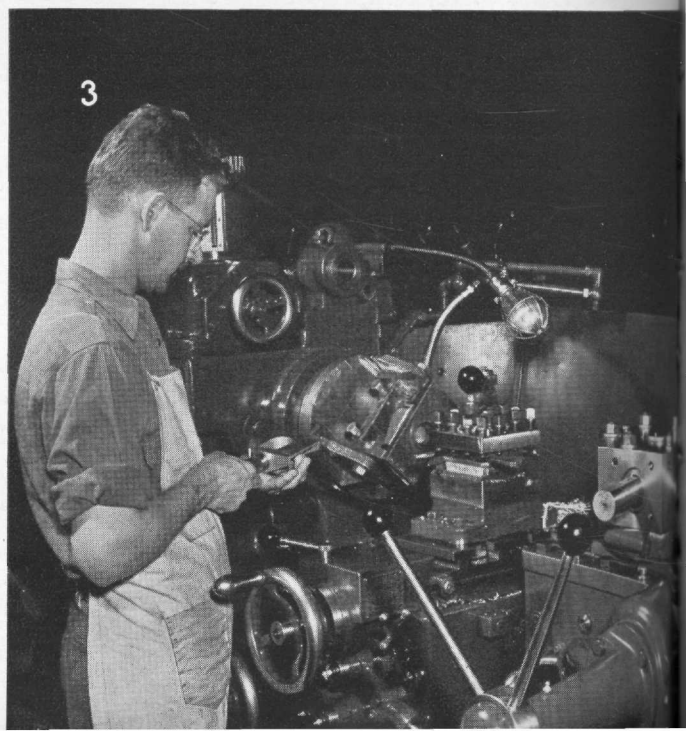

Gaging a Piece that Has Been Bored in a Turret Lathe

Courtesy Machine Tools

INDUSTRIAL TRAINING

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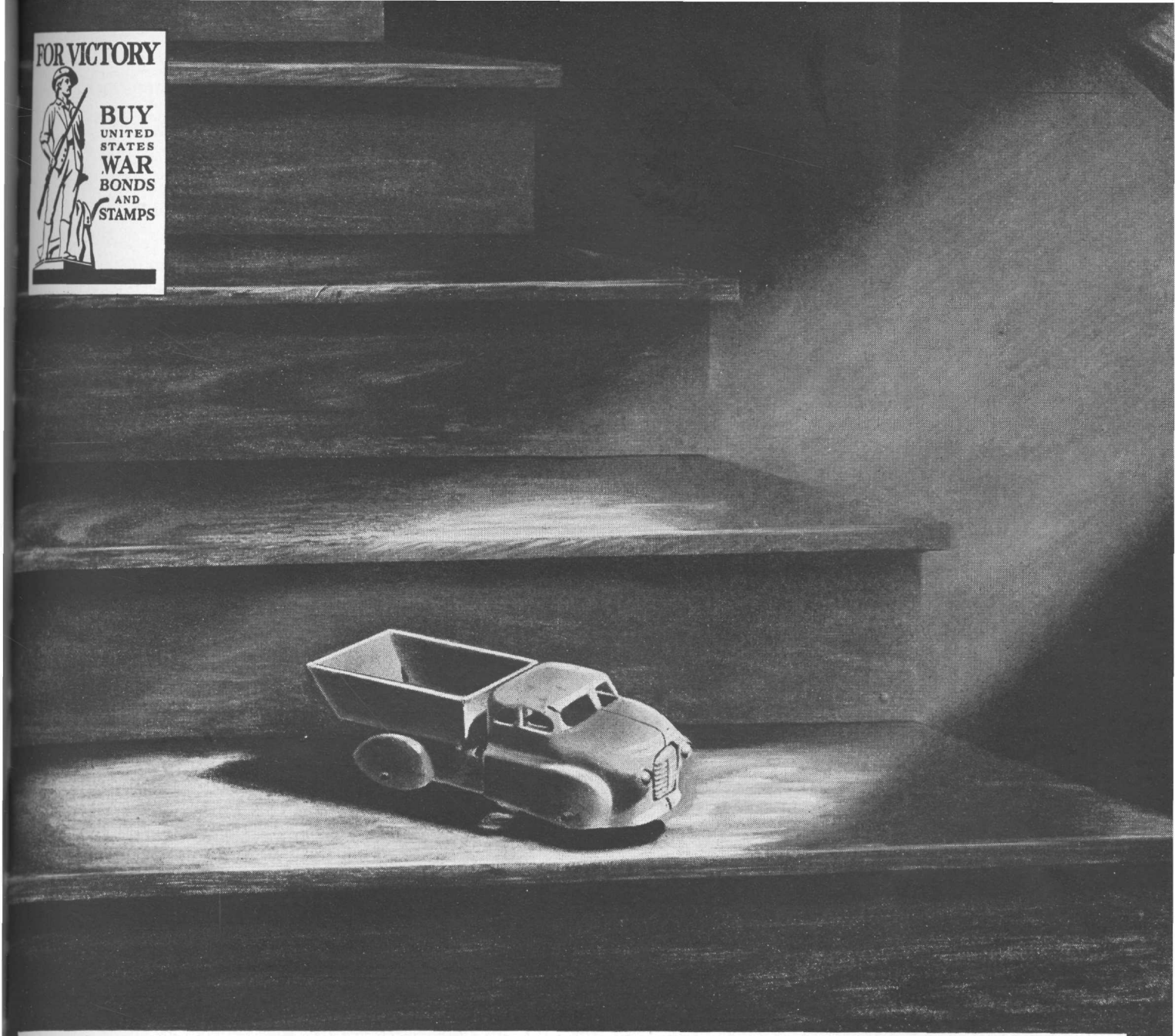
physical examination by the company doctor, he is ushered into the apprentice training room. Here, the foreman tells him, "Here is a blueprint of some bosses to be welded on motor frames. Take the number three shaper. Stock is at the machine." Knowing naught of the operation of a shaper the novice has to learn the functions of the various controls by trial and by asking fellow apprentices near him. He machines the order of welding bosses and asks his foreman for another job. He is given a more difficult shaper job. Errors are many and they are in steel. Since his finished work is inspected by the tool room inspector the work must be accurate. Several phases of apprentice training early come to light; often the foreman will require that the apprentice hold his work to finer tolerances than are actually necessary and produce better finishes than the drawings request. This is done for two reasons; it teaches the apprentice how to produce high quality work and it makes it easier for the apprentice department to get work from other departments for their machines since their work is of a higher quality than produced "on production." Also, the apprentice learns to a large degree by "error"; he remembers vividly any mistakes he makes and takes inordinate care that they do not occur again. This must necessarily be the method used since an apprentice cannot be shown the correct procedures of operation on all of the standard machines in his shop lectures and demonstrations before he is called upon to work on the various machines. The shaper work the apprentice receives slowly becomes more intricate and difficult until he is doing profile and irregular shaping or shaping of pieces that have special and irregular forms. As the apprentice stays with his machine he begins to appreciate its capabilities and limitations. Furthermore, he unconsciously gains a "feel" for the shaper.

Until now the apprentice has only initiated work on a piece; i.e., he has worked with stock which was not machined previous to his machining of the material. Now, he may be placed on a cylindrical grinder and have semi-finished work as his raw material. He learns, on the cylindrical grinder, to work to tolerances he had only thought of before, plus one ten thousandth of an inch and minus nothing. Also, he begins to fully appreciate the quality of the work already put on the piece and realizes that any scrap he now produces will waste not only his work but some other individual's, too. The work may consist of grinding tensile test pieces, fatigue test pieces, valve stems, axles, counterbores, drills, milling cutters, and similar circular tools. The apprentice is then shifted to the surface grinder. The similarity between this work and shaper work is striking; the main difference seems to lie in the increased precision of the machine. The effect of overheating the work by the too sudden removal of metal, or the use of a dull grinding wheel, appears as warpage and "burning" of the piece. The coordination of both hands that was acquired while working on the lathe is necessary here to do good work quickly. The work on a surface grinder is usually quite varied and ranges from cut-off work with rubber wheels to face grinding with cup wheels and includes plate grinding with straight wheels.

After about six months of bench work, which includes small die work, special machines, and special meter work, the apprentice is "farmed out" to the shop. He may go to the locomotive tool and die shop where he will make welding jigs, drill jigs, assembly fixtures, shear dies, and drop forge dies. In this shop, the foreman will place considerable responsibility on the apprentice by letting him check his own finished work. Also, since many of the tool drawings are produced under extreme pressure, the apprentice may sometimes use the tool drawing as a guide rather than follow the details faithfully to produce a fixture that will perform the same function and may more readily be made with the machines and stock available. The apprentice gets his first taste of die sinking in this department. This is a good place to begin since the dies are for drop forgings. The locomotive tool and die department gives ample opportunity for increased responsibility.

After graduation the new ex-apprentice has his choice of many jobs. If he goes into an engineering office he will be primarily concerned with calculation of engineering data. If he goes into production he will work on a machine at which he has become proficient and will probably be the highest paid of any of the members of his class. If he goes into a tool room, he will have the finest machine work available and the best machines with which to do his work. His pay will be less than that paid on production but it will have a higher ceiling. If he goes into production control he has his foot in the door leading to plant management. Tool design is a comparatively low paying job to start with but will increase rapidly as he becomes proficient in this field. An instructorship will lead to a foreman's position if the former apprentice desires to work with men.



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Where did these accidents happen? Two-thirds of them happened outside of industry. In the home, where workers take chances they would not dream of taking on the job. They happened in darkened hallways . . . in bath tubs . . . in garages and basements. They happened in industry where someone gambled with safety.

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